SCARBOROUGH 1988

AIR QUALITY SURVEY IN THE VICINITY OF GENERAL MOTORS CORPORATION OF CANADA LIMITED (SCARBOROUGH PLANT)

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Environment Ontario

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OF GENERAL MOTORS CORPORATION
OF CANADA LIMITED (SCARBOROUGH PLANT)

Ronald Bell

Air Resources Branch

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March 1989

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EXECUTIVE SUMMARY

At the request of the Central Region of the Ministry of the Environment, Mobile Air Monitoring Unit #1 of the Air Resources Branch performed an air quality survey in the vicinity of the General Motors Corporation (Scarborough) plant from May 31 to June 10, 1988. Odour complaints were received from the local residents attributed to emissions from the painting operations of this plant. Thus the main aims of this survey were to provide on-site screening of the ambient air in this locale and downwind of the painting operations at the plant; try to identify any odour causing gaseous contaminants; and note if any of the applicable Ministry Air Quality Standards, Criteria, Guidelines or Provisional Guidelines were exceeded for any of the measured contaminants.

Thirty monitoring periods comprised this air quality study and the ambient air was screened for 132 different volatile organic compounds (VOCs) and 10 different (mainly inorganic) gaseous common contaminants. During this study, 19 VOC samples and almost 150 hours of common contaminant data were acquired. Very little odour was detected and most of the air quality results were low. None of the applicable Ministry Air Quality Standards, Criteria, Guidelines or Provisional Guidelines were approached or exceeded.

As expected, xylenes and toluene were the major organics detected downwind of the painting operations but their concentrations were low (444 and 103 ug/m^3 (micrograms per cubic metre) respectively) when compared to their Ministry Standards (2300 and 2000 ug/m^3 respectively). The average total organic concentration detected downwind of the plant was approximately 400 ug/m^3 and although an average of 70 different organics were detected, the majority were at trace levels or at concentrations near the detection limit of the gas chromatographic system. Only 12

of the organics had maximum one-hour average concentrations in excess of 20 ug/m^3 and of these, the major ones were xylenes (444 ug/m^3), toluene (103 ug/m^3), butane (131 ug/m^3) and 2-methylbutane (100 ug/m^3). At some of the downwind locations, only a faint sweet odour of aromatic organics was detected by the field staff and the odours were not considered to be offensive or strong.

For the common contaminants, the maximum half-hour average concentrations of carbon monoxide, oxides of nitrogen and non-methane hydrocarbons measured downind of the plant were 3.1, 0.13 and 1.9 ppm (parts per million) respectively. These maxima were usually measured between 17:00 and 19:00 hrs and a major source was thought to be rush-hour traffic and yard-traffic at the plant.

Although most of the odour complaints originated from the courthouse and shopping plaza areas east and northeast of the plant, no offensive odours were detected and no monitoring was conducted in these areas.

Table of Abbreviations

CH_4	methane
CO	carbon monoxide
GC	gas chromatograph
i.e.	that is
km/hr	kilometres per hour
MAMU	Mobile Air Monitoring Unit
na.	not available
nd.	not detected
NO	nitric oxide
NO_x	oxides of nitrogen
NO_2	nitrogen dioxide
O_3	ozone
ppm	parts per million
SO_2	sulphur dioxide
TRS	total reduced sulphur compounds
THC	total hydrocarbon compounds
TH-M	non-methane hydrocarbons
ug/m^3	micrograms per cubic metre
VOC(s)	volatile organic compound(s)

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Plant Process Description and Operating Conditions
(as supplied by Region)

1.0 **Background and Introduction**

General Motors Corporation (of Canada) Limited operates a van assembly plant in Scarborough, Ontario. This GMC Scarborough plant is located at 1901 Eglinton Avenue East, just west of Pharmacy Avenue. Approximately 2500 personnel are employed at this plant and production scheduling is based on 2 daily shifts running continuously from 07:00 hrs to 01:30 hrs, 5 days per week with prescheduled weekend overtime. Almost 400 vans are produced daily with an additional 200 units being manufactured during the Saturday production runs.

As part of production, the vans are immersed in an electrostatic dip tank and passed through 3 different paint spraying booths and drying ovens. The paint spray is both automatic and manual and is used for surface coating of van bodies. The spray booths are totally enclosed structures and ventilation is achieved by means of either horizontal or downdraft air flow through water wash curtains. Apart from the vans that pass through these booths and ovens daily, another smaller area of the plant is used each day for the processing of almost 1600 wheel rims. The rims are painted and cured and as with the van painting operation, ventilation of this area is achieved by means of air flow through water wash curtains. Approximately half of the estimated 150 different stacks that are atop this plant originate from the spray booths and drying ovens. The emergent gases are nominally cool and the stack heights vary from approximately 30 to 35 metres above ground level.

The Central Region, Abatement West Section has received odour complaints regarding emissions from this GM Scarborough plant. The majority of the complaints originated from the shopping plaza and courthouse areas immediately to the northeast of this plant and the odours were thought to have been coming from the painting operation. As a result, the Central Region contacted the Air

Resources Branch and Mobile Air Monitoring Unit #1 conducted an air quality survey in the vicinity of this plant during the first two weeks of June, 1988. The main aims of this survey were (a) to position the monitoring unit in areas of odour to provide on-site screening of the ambient air; (b) try to identify the odour-causing contaminants; and (c) note if any of the applicable Ministry Air Quality Standards, Criteria, Guidelines or Provisional Guidelines were exceeded for any of the detected compounds.

2.0 **The Monitoring Programme**

The mobile air monitoring unit used during this survey contained a variety of analyzers that enabled screening of the ambient air for 132 different volatile organic compounds and 10 different (mainly inorganic) common contaminants.

The most versatile analyzer was the dual capillary column gas chromatographic system which was used for the detection, identification and quantification of VOCs. To detect individual VOCs at the 1 to 10 ug/m^3 concentration level, ambient air was drawn through a trace organic preconcentrator unit for a set period of time. In the preconcentrator, the organics were adsorbed onto a Carbotrap-Spherocarb cartridge and then thermally desorbed and prefocused onto a nickel loop cooled to -195 ^{o}C with liquid nitrogen. The prefocussed organics were then flash-vapourized and injected simultaneously onto the heads of two 25 metre capillary columns (OV-1 and SE-54) where the individual organics were separated. The eluted organics were then detected by flame ionization detectors. Positive identification of the eluted volatile organic compounds was assisted by a computer which compared and correlated the results with a library of retention indices which had been established from earlier calibration tests.

The monitoring unit also housed a complete ground-based meteorological station which continuously recorded wind direction and speed, ambient temperature, humidity, solar radiation and barometric pressure data.

A more detailed description of the specific monitoring capabilities of the monitoring unit is listed in Table 1. The gaseous contaminants together with applicable Ministry of the Environment Standards, Criteria, Guidelines and Provisional Guidelines are presented in Table 2.

The daily monitoring programme consisted of performing calibration checks on all analyzers each morning and then acquiring air quality data in the vicinity of the General Motors' plant whenever possible; usually, monitoring would be carried out downwind initially and then at a later time, upwind.

As presented in Table 3, this survey lasted from May 31 to June 10, 1988. During this time, 1 VOC sample and approximately 120 hours of common contaminant data were acquired on plant property. These data were acquired during 16 different monitoring periods and the majority was acquired during the night when the monitoring unit was unmanned. All other monitoring was conducted off plant property. Thirteen VOC samples and almost 26 hours of common contaminant data were acquired downwind on 9 different occasions and 5 VOC samples together with almost 6 hours of common contaminant data were acquired upwind during 5 other occasions.

For assistance in the deployment of the monitoring unit, an in-house Ministry programme for the calculation of single source maximum ground level concentrations for compliance with Regulation 308 under C and D stabilities was run. Using the assumptions: a stack height of 36 metres; an emission rate of 1 gram per second; an exit velocity of 15 metres per second; a stack diameter of 1 metre and an ambient temperature of 25 ^{o}C; this programme reported that the downwind distances at which maximum concentrations would be measured were in the range of approximately 0.5 to 1 km. Accordingly and taking into account low level fugitive emissions, all downwind air quality monitoring was within this range.

As reported by plant personnel, the non-aqueous dispersion enamels, epoxy primers, tints, thiners and other finishes used in this plant are mixed with several solvents prior to and during application. The major solvents were xylenes, toluene, acetone, butyl alcohol and aromatic organics. Of these, the gas

chromatograph system was able to identify and quantitate xylenes, toluene and approximately 30 more of the common aromatic organics (Table 2). Since the drying ovens are gas-fired, monitoring of the common contaminants CO, NOx and TH-M was deemed important. As a consequence, the downwind single source monitoring results for CO, NOx and TH-M were expressed as maximum half-hour average ground level concentrations. When general air quality was monitored, the ground level concentrations of CO, NO_2 and TH-M were reported as maximum one-hour averages.

3.0 **Discussion of Results**

3.1 The Weather

During Tuesday, Wednesday and Thursday (May 31, June 1 and 2), a weak cold front dominated the weather picture in southern Ontario. The winds were generally light northwesterly veering to northeasterly by Thursday. The days were mainly sunny with highs in the mid-thirities and overnight lows in the mid-teens.

On Friday, June 3 a weak disturbance had pushed northward from the States. The day was overcast with rain in the afternoon. The winds remained easterly and the afternoon high was 17 ^{0}C.

On Monday, Tuesday and Wednesday (June 6, 7 and 8) a slow moving frontal system was over the Great Lakes. It was generally overcast with rain showers and the winds were northwesterly 10 to 20 km/hr. The afternoon highs reached 30 ^{o}C and the overnight lows were near 5 ^{o}C.

On Thursday and Friday, a weak high pressure area was over most of southern Ontario. The air mass was generally dry and stable and the winds were northwesterly 20-30 km/hr. These were sunny days with afternoon highs near 20 ^{o}C and overnight lows near 5 ^{o}C.

Several points should be made regarding the weather and monitoring programme.

(a) The overnight monitoring site was on GM property, adjacent to and south of the physical plant. Although this site was approximately 0.2 km southeast of the paint stacks, it was somewhat shielded by the physical plant building. Odours were detected at this site but because of the close proximity of the building, the acquired wind data were judged to be invalid and had to be ignored.

(b) The majority of the odour complaints originated from the courthouse and plaza areas adjacent to and east / northeast of the GMC plant. Throughout the two weeks of monitoring, westerly and southwesterly winds were not present. Monitoring in these two areas was never undertaken since during the survey no odours were detected in these areas and they were never downwind of the plant.

(c) The plant was NOT in operation on June 7 and the field staff were not informed of this until the following day. Two VOC samples and 4 hours of common contaminant data were acquired downwind and 1 VOC sample and just over 1 hour of common contaminant data were acquired upwind. As expected, very little source contribution was evident as these upwind and downwind data sets were very similar (Tables 4 and 5).

(d) Although 60 to 80 different organics were detected in the acquired VOC samples, 13 of these accounted for over 75% of the total concentrations. In other words, apart from these 13, all other concentrations were usually at ultra-trace levels or just above their respective detection limits (Tables 5 and 6).

3.2 Downwind Measurements

If the data of June 7 is included, 13 VOC samples and almost 26 hours of common contaminant data were acquired during 9 different monitoring periods downwind of the GMC (Scarborough) plant (Table 3).

For the common contaminants, the maximum half-hour average ground level concentrations of TH-M, CO, NOx, NO_2 and SO_2 were reasonably low at 1.9, 3.1, 0.13, 0.05 and 0.03 ppm respectively (Tables 4 and 6). Of these, Air Quality Criteria for CO (30 ppm), NO_2 (0.20 ppm) and SO_2 (0.25 ppm) exist (Table 2). These Criteria are statements of allowable maximum one-hour average ground level concentrations. If the maximum half-hour averages are less than these Criteria, then the Criteria are not exceeded. From these data, the half-hour average ground level concentrations were all less than their respective Criteria.

Although the ambient air downwind of the GMC plant was screened for 132 different VOCs, a maximum of 80 different VOCs were detected in the 14 one-hour samples (including the sample collected on-site; A012)). The maximum organic concentration detected in any of these samples was 1277 ug/m^3 (Table 5; A012) whereas the average total concentration was 395 ug/m^3. Most of the VOCs were detected at trace amounts since only 12 had concentrations in excess of 20 ug/m^3. With the inclusion of benzene, these 13 VOCs accounted for almost 80% of the average total organic concentrations (the Major VOCs in Table 6; 312 of 395 ug/m^3). The more dominant VOCs were the xylenes, toluene, ethylbenzene, butane and 2-methylbutane with average concentrations of 144, 41, 28, 26 and 23 ug/m^3 respectively. Of the 13 major VOCs, the Ministry has applicable Standards, Criteria and Guidelines for the following: xylenes (2,300 ug/m^3; Standard & Criterion), toluene (2,000 ug/m^3; Standard & Criterion); ethylbenzene (4,000 ug/m^3; Standard & Criterion), hexane (35,000;

Guideline), benzene (10,000 ug/m^3; Standard but under review) and 1,2,4-trimethylbenzene (100 ug/m^3; Guideline and 1,000 ug/m^3; Criterion). The maximum one-hour average concentrations of xylenes, toluene, ethylbenzene, hexane, benzene and 1,2,4-trimethylbenzene were 444, 103, 80, 24, 13 and 60 ug/m^3 rewspectively (Table 6). Thus the detected VOC concentrations were less than their applicable Ministry Standards, Criteria and Guidelines.

The highest contaminant concentrations were detected on June 1 (A012 and A013; Table 3). It was cloudy; the winds were northwesterly and the field staff noted strong, sweet aromatic type odours at the physical plant and on Comstock Road. The physical plant was approximately 0.2 km downwind of the GMC paint stacks and the Comstock Road site (50 metres east of the south control gate) was approximately 0.8 km downwind. The ground level concentrations of the common contaminants and the number of different VOCs (approximately 80) detected at these 2 sites were essentially the same (Table 4). However the total organic concentrations dropped by approximately 50% at the off plant site (approximately 700 ug/m^3) versus the on plant site (approximately 1300 ug/m^3; Table 5). Of the 80 VOCs, the major ones were xylenes, toluene, butane and 2-methylbutane. At the Comstock site, the one-hour average concentrations for these VOCs were 290, 70, 20 and 20 ug/m^3 respectively and at the physical plant, they were 444, 103, 131 and 100 ug/m^3. After 16:00 hrs, the monitoring unit moved upwind to a site at Centinnial College (A014; Table 3). From the acquired data, the oxides of nitrogen data were essentially the same as those detected downwind (0.03 ppm) whereas a slight decrease in TH-M (0.9 versus 1.7 ppm), CO (0.2 versus 0.7 ppm) and SO_2 (less than 0.01 ppm versus 0.03 ppm) concentrations were noted. From analysis of the single VOC sample, the total organic concentration was only 41 ug/m^3 with only trace amounts of xylenes and toluene being detected.

As mentioned in Section 3.1, the GMC plant was not in operation on June 7. During this day, the monitoring unit acquired

data at 2 different downwind sites and 1 upwind site before this information was received by the field staff. Four hours of common contaminant data and 2 VOC samples were acquired downwind and just over 1 hour of common contaminant data and 1 upwind sample were acquired upwind (A073, A074 and A075; Table 3). As expected, the monitored concentrations were low and the results were all similar. For the VOCs, the overall average organic concentrations ranged from 197 to 280 ug/m^3 with no individual VOC concentration greater than 51 ug/m^3 (toluene; in the upwind sample). From analyses of the 2 downwind samples, only 9 major VOCs were detected with the dominant ones being toluene, butane and 2-methylbutane (Table 5).

3.3 Upwind Measurements

No offensive odours were detected and almost 6 hours of common contaminant data together with 5 VOC samples were acquired during 5 different monitoring periods upwind of this GMC plant.

Very low ground level concentrations of the common contaminants were measured as the maximum half-hour average concentrations ranged from 0.3 to 1.1 ppm for TH-M, 0.2 to 1.6 ppm for CO and 0.01 to 0.08 ppm for NOx (Table 6).

Similarily, low concentrations of the VOCs were detected. Although 60 to 70 different VOCs were detected, the maximum and average total organic concentrations were only 273 and 151 ug/m^3 (Table 6). The major VOCs were the xylenes, toluene, butane and 2-methylbutane and yet, no individual concentration exceeded 52 ug/m^3 (toluene).

3.4 On-Site Measurements

The monitoring unit was positioned along the south side of

the GMC physical plant during these measurements. Most of the measurements were acquired during the mornings just after calibrations and usually during periods of very light or calm winds (Table 3). Nine different monitoring periods comprised this segment of the survey and just over 22 hours of common contaminant data and 1 VOC sample were collected. The wind data acquired during these periods were not valid due to the close proximity of the physical plant building.

The single VOC sample was collected on June 1 (A012) and the discussion of its analysis was presented in Section 3.2.

The concentrations of the common contaminants were slightly higher than those measured off plant property but all were less than the stated Ministry Standards and Criteria (Tables 2, 4 and 6). The maximum half-hour average ground level concentrations of TH-M, CO and NOx ranged from 0.8 to 3.4 ppm, 0.3 to 1.3 ppm and 0.02 to 0.07 ppm respectively.

The maximum ground level concentrations of TH-M and CO (3.4 and 1.3 ppm) were measured during the mid-afternoon on June 31 (A313; Table 4). The winds were light northwesterly and it was very hot with ambient temperatures 35 to 40 ^{o}C. Although no offensive odours were noted by the field staff, the monitoring unit was thought to be downwind of the drying ovens and paint booth stacks. No SO_2 was detected and the NOx concentrations were also very low (0.03 ppm).

3.5 Overnight Measurements

Overnight monitoring was conducted on 7 different occasions during this study. The monitoring unit was always at the physical plant and approximately 95 hours of common contaminant data were acquired (Table 3).

Since the monitoring unit was usually unattended and the wind data was questionable due to the closeness of the physical plant building, the source(s) of the measured contaminants could not be determined with any degree of certainity. For these reasons, the acquired common contaminant data could only be compared with existing Ministry Air Quality Criteria but even these are not strictly applicable, since the monitoring took place on plant property.

As noted in Table 4, no SO_2 was detected during these periods and the maximum one-hour average ground level concentrations of TH-M ranged from 0.3 to 4.8 ppm; of CO from 0.8 to 5.1 ppm; of NO_2 from 0.03 to 0.05 ppm. The Ministry Air Quality Criteria for SO_2, CO and NO_2 are 0.25, 30 and 0.20 ppm respectively. No criterion exists for TH-M.

The 5 ppm of CO was measured during monitoring period A063 between 17:00 and 18:00 hrs. The prevailing winds were westerly and although very little NOx (0.04 ppm) was measured and the TH-M concentrations were only 1.5 pm, the most plausible source of this contaminant was vehicular rush-hour traffic or yard traffic at the plant.

The 4.8 ppm of TH-M was measured almost under identical circumstances. It was recorded during the rush-hour (17:00 to 18:00 hrs) of the first evening (A314). It was very hot (35 ^{o}C) and the winds were calm. Again very little NOx was measured (0.03 ppm) and the CO one-hour average concentration was 1.3 ppm. Yard traffic or rush-hour traffic were assumed to be the most logical source(s) of these contaminants.

4.0 Conclusions

Thirty monitoring periods comprised this air quality study which ran from May 31 to June 10, 1988. The ambient air was screened for 132 different volatile organic compounds (VOCs) and 10 different (mainly inorganic) gaseous common contaminants. During this study, 19 VOC samples and almost 150 hours of common contaminant data were acquired. Very little odour was detected and most of the air quality results were low as none of the applicable Ministry Air Quality Standards, Criteria, Guidelines or Provisional Guidelines were approached or exceeded.

On several occasions, especially when the monitoring unit was on plant property, a faint sweet aromatic odour was discernible downwind of the stacks from the paint and drying operations conducted at this plant. From analyses of the 13 downwind VOC samples acquired off plant property, 70 to 80 different organics were detected but the concentrations were usually at ultra trace levels or just at the detection limits of the analytical system. Only 12 or 13 of these organics were detected at concentrations greater than 20 ug/m^3. (The Ministry Criteria, Guidelines, etc. for these gaseous contaminants are usually in the 100 to 10,000 ug/m^3 range.) The maximum organic concentration detected off plant property was approximately 700 ug/m^3. The VOC sample was collected along Comstock Road, approximately 0.8 km downwind of the paint stacks. A weak aromatic odour was present at this site and xylenes and toluene accounted for almost 50% of the total organic concentration. (The maximum total organic concentration detected during this entire study was approximately 1300 ug/m^3. Although the sample was acquired downwind of the paint stacks, it was collected on plant property at the physical plant site.)

From analyses of all the downwind VOC samples, the average

total organic concentration was approximately 400 ug/m^3 with the aforementioned 12 or 13 organics accounting for over 75% of the totals. The major organics were xylenes (average and maximum concentrations of 144 and 444 ug/m^3), toluene (41 and 103 ug/m^3), butane (26 and 131 ug/m^3), 2-methylbutane (23 and 100 ug/m^3) and 1,2,4-trimethylbenzene (16 and 60 ug/m^3).

The maximum and average total organic concentrations detected upwind and off plant property were approximately 275 and 150 ug/m^3. As with the downwind measuements, the major organics were xylenes (average and maximum concentrations of 16 and 26 ug/m^3), toluene (30 and 52 ug/m^3), butane (11 and 24 ug/m^3) and 2-methylbutane (14 and 24 ug/m^3).

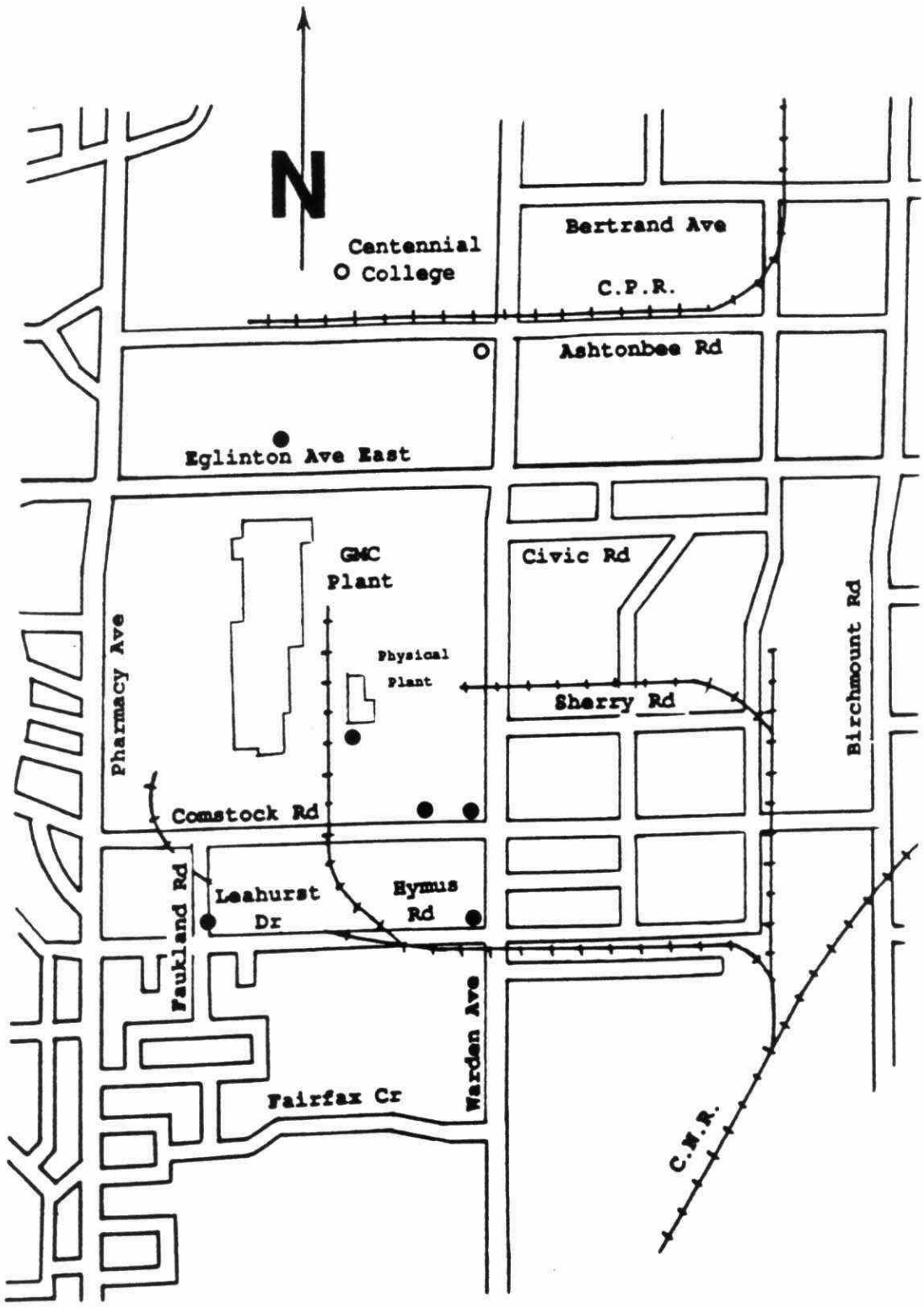
As for the common contaminants, low concentrations were measured. The concentrations monitored upwind were approximately half of those measured downwind. For example, the maximum half-hour average concentrations of CO measured upwind and downwind were 1.6 and 3.1 ppm; of NOx, 0.08 and 0.13 ppm; and of TH-M, 1.1 and 1.9 ppm. None of the applicable Ministry Air Quality Criteria associated with these contaminants were exceeded and a major source of CO and NOx is this area was thought to be rush-hour traffic and yard traffic at the plant.

Although most of the odour complaints received by the Ministry originated from the courthouse and shopping plaza areas east and northeast of the GMC (Scarborough) plant, no offensive odours were detected and no monitoring was conducted in these areas since the winds were never westerly or southwesterly during the survey.

Appendix A

(The Data)

Figure 1
General Area and Monitoring Locations



Scale 1:10,000

Table 1

THE INSTRUMENTATION OF MOBILE AIR MONITORING UNIT #1

Instrument	Manufacturer	Analytical Technique	Full Scale Sensitivity
THC, CH4, TH-M analyzer	Ingenieur-Produktions-Gruppe Munchen (IPM) RS-t	Dual flame ionization	50 ppm THC (as CH4)
H2S, SO2, NOx sources	Hartmann & Braun Prufgasgenerator	N/A	N/A
TRS/SO2 analyzer	Monitor Labs 8850 c/w ML 8770	Fluorescence	0.5 ppm SO2 0.5 ppm TRS
NOx, NO2, NO analyzer	Monitor Labs 8840	Chemi-Luminescence	1.0 ppm NOx (as NO2)
CO analyzer	Thermo Electron P48	Gas Filter Correlation	100 ppm CO (digital)
O3 analyzer/ source	Dasibi 1003-AAS	UV Absorption	1.0 ppm O3 (digital)
Hewlett Packard Data Acquisition System - HP 85 and HP 3497A			
Gas Chromatograph	HP 5880 Dual Capillary Column c/w HP 86 Data Acquisition System	Flame Ionization Det.	as set per calibrations

Meteorological Instrumentation

Instrument	Manufacturer	Scale
** Wind speed	Lambrecht GmBH	km/hr
** Wind direction	Lambrecht GmBH	degrees
Temperature	Weather Measure (WM) T621	degrees Celsius
Humidity	WM-HM-11P	absolute & %
Barometric pressure	WM-BM70-B242	millibars
Solar Radiation	WM Star Pyranometer	milliwatts/cm2

** These instruments are located on top of a 10 metre retractable tower

Table 2

The Volatile Organic Compounds Measured by the Gas Chromatographic System of MAMU #1

All concentrations are in ug/m^3 (micrograms per cubic metre)

		Standards, Guidelines or Provisional Guidelines	Criterion	TWA	STEL	Alternate Names
1	PROPANE					
2	PROPADIENE					ALLENE
3	PROPYNE					METHYL ACETYLENE
4	CYCLOPROPANE					
5	2-METHYLPROPANE					ISOBUTANE
6	CHLOROETHENE	560 (2)	280 (A)	5000	10000	VINYL CHLORIDE; CHLOROETHYLENE
7	1-BUTENE					
8	1,3-BUTADIENE					
9	BUTANE			1900000		*n-BUTANE*
10	1-BUTYNE					ETHYLACETYLENE
11	CHLOROETHANE			2600000	3250000	ETHYL CHLORIDE
12	3-METHYL-1-BUTENE					ISOAMYLENE
13	2-METHYLBUTANE					ISOPENTANE
14	2-METHYL-1-BUTENE					
15	PENTANE			1800000	2250000	*N-PENTANE*
16	2-METHYL-1,3-BUTADIENE					ISOPRENE
17	trans-2-PENTENE					
18	cis-2-PENTENE					
19	DICHLOROMETHANE	100000 (1)	100000 (A)	350000	1740000	METHYLENE CHLORIDE
20	2-METHYL-2-BUTENE					

Table 2 ctd.

The Volatile Organic Compounds Measured by the Gas Chromatographic System of MAMU #1

All concentrations are in ug/m^3 (micrograms per cubic metre)

		Standards, Guidelines or Provisional Guidelines	Criterion	TWA	STEL	Alternate Names
21	2,2-DIMETHYLBUTANE					NEOHEXANE
22	trans-1,2-DICHLOROETHENE					
23	3-METHYL-1-PENTENE					
24	4-METHYL-1-PENTENE					
25	CYCLOPENTANE					
26	2,3-DIMETHYLBUTANE					
27	2-METHYLPENTANE					
28	3-METHYLPENTANE					
29	1-HEXENE					
30	cis-1,2-DICHLOROETHENE			790000	1000000	cis-1,2-DICHLOROETHYLENE; SYM-DICHLOROETHYLENE
31	2-CHLOROBUTANE					sec-BUTYL CHLORIDE
32	1-CHLORO-2-METHYLPROPANE					
33	HEXANE	35000 (2)	12000 (A)	180000		*n-HEXANE*
34	CHLOROFORM	1500 (2)	500 (A)	50000	225000	TRICHLOROMETHANE
35	3-CHLORO-2-METHYLPROPENE					ISOBUTENYL CHLORIDE
36	METHYLCYCLOPENTANE					
37	2,4-DIMETHYLPENTANE					
38	1,2-DICHLOROETHANE			40000	60000	ETHYLENE CHLORIDE
39	2,2-DIMETHYLPENTANE					
40	1,1,1-TRICHLOROETHANE	350000 (1)	115000 (A)	19000000	2450000	METHYL CHLOROFORM

Table 2 ctd.

The Volatile Organic Compounds Measured by the Gas Chromatographic System of MAMU #1

All concentrations are in ug/m^3 (micrograms per cubic metre)

	Standards, Guidelines or Provisional Guidelines	Criterion	TWA	STEL	Alternate Names
41 1-CHLOROBUTANE					n-BUTYL CHLORIDE
42 BENZENE	10000 (1)	3300 (A)	30000	75000	
43 TETRACHLOROMETHANE	1800 (2)	600 (A)	20000	125000	CARBON TETRACHLORIDE
44 3,3-DIMETHYLPENTANE					
45 CYCLOHEXANE	300000 (2)	100000 (A)	1050000	1300000	HEXAHYDROBENZENE
46 2,3-DIMETHYLPENTANE					
47 2-METHYLHEXANE					ISOHEPTANE
48 CYCLOHEXENE			1015000		
49 DIBROMOMETHANE					METHYLENE DIBROMIDE; METHYLENE BROMIDE
50 1,2-DICHLOROPROPANE					PROPYLENE CHLORIDE
51 3-METHYLHEXANE					
52 2,3-DICHLOROPROPENE			5000	50000	2,3-DICHLOROPROPYLENE
53 TRICHLOROETHENE	85000 (1)	28000 (A)	270000	1080000	TRICHLOROETHYLENE
54 2,2,4-TRIMETHYLPENTANE					ISOOCTANE
55 1-HEPTENE					
56 HEPTANE			1600000	2000000	*n-HEPTANE*
57 trans-2-HEPTENE					
58 METHYLCYCLOHEXANE			1600000	2000000	HEXAHYDROTOLUENE
59 2,2-DIMETHYLHEXANE					
60 ETHYLCYCLOPENTANE					

Table 2 ctd.

The Volatile Organic Compounds Measured by the Gas Chromatographic System of MAMU #1

All concentrations are in ug/m^3 (micrograms per cubic metre)

	Standards, Guidelines or Provisional Guidelines	Criterion	TWA	STEL	Alternate Names
61 4-METHYLCYCLOHEXENE					
62 2,5-DIMETHYLHEXANE					
63 1-CHLOROPENTANE					n-AMYL CHLORIDE; PENTYL CHLORIDE
64 1,1,2-TRICHLOROETHANE					VINYL TRICHLORIDE
65 2,3,4-TRIMETHYLPENTANE					
66 TOLUENE	2000 (1)	2000 (A)	375000	560000	*METHYLBENZENE*; PHENYLMETHANE
67 1,3-DICHLOROPROPANE			350000	510000	TRIMETHYLENE CHLORIDE
68 2-METHYLHEPTANE					
69 4-METHYLHEPTANE					
70 c-1,3-DIMETHYLCYCLOHEXANE					
71 3-METHYLHEPTANE					
72 1,2-DIBROMOETHANE					ETHYLENE DIBROMIDE; ETHYLENE BROMIDE
73 1,1-DIMETHYLCYCLOHEXANE					
74 1-OCTENE	150000 (3)	50000 (A)			
75 trans12DIMETHYLCYCLOHEXANE					*trans-1,2-DIMETHYLCYCLOHEXANE
76 trans-4-OCTENE					
77 TETRACHLOROETHENE	10000 (2)	4000 (A)	335000	1340000	TETRACHLOROETHYLENE; PERCHLOROETHYLENE
78 c-1,4-DIMETHYLCYCLOHEXANE					
79 OCTANE	45400 (3)	15300 (A)	1450000	1800000	*n-OCTANE*
80 trans-2-OCTENE					

Table 2 ctd.

The Volatile Organic Compounds Measured by the Gas Chromatographic System of MAMU #1

All concentrations are in ug/m^3 (micrograms per cubic metre)

		Standards, Guidelines or Provisional Guidelines	Criterion	TWA	STEL	Alternate Names
81	cis12DIMETHYLCYCLOHEXANE					
82	CHLOROBENZENE			350000		PHENYL CHLORIDE
83	ETHYLCYCLOHEXANE					
84	1-CHLOROHEXANE					n-HEXYL CHLORIDE
85	ETHYLBENZENE	4000 (1)	4000 (A)	435000	545000	
86	m&p-XYLENES	2300 (4)	2300 (A)	435000	655000	*1,3-DIMETHYLBENZENE*
87	4-METHYLOCTANE					
88	2-METHYLOCTANE					
89	3-METHYLOCTANE					
90	STYRENE	400 (1)	400 (A)	215000	425000	*ETHENYLBENZENE*; PHENYLETHYLENE; VINYLBENZENE
91	1,4-DICHLOROBUTANE					
92	o-XYLENE	2300 (4)	2300 (A)	435000	655000	*1,2-DIMETHYLBENZENE*
93	1,1,2,2-TETRACHLOROETHANE					ACETYLENE TETRACHLORIDE
94	1,2,3-TRICHLOROPROPANE			300000	450000	TRICHLOROHYDRIN
95	1-NONENE					
96	NONANE			1050000	1300000	*n-NONANE*
97	ISOPROPYLBENZENE	100 (3)	100 (B)			*(1-METHYLETHYL)BENZENE*; CUMENE
98	2-CHLOROTOLUENE					*2-CHLORO-1-METHYLBENZENE*; o-TOLYL CHLORIDE; o-CHLOROTOLUENE
99	3-CHLOROTOLUENE					*3-CHLORO-1-METHYLBENZENE*; m-TOLYL CHLORIDE; m-CHLOROTOLUENE
100	4-CHLOROTOLUENE					*4-CHLORO-1-METHYLBENZENE; p-TOLYL CHLORIDE; p-CHLOROTOLUENE

Table 2 ctd.

The Volatile Organic Compounds Measured by the Gas Chromatographic System of MAMU #1

All concentrations are in ug/m^3 (micrograms per cubic metre)

	Standards, Guidelines or Provisional Guidelines	Criterion	TWA	STEL	Alternate Names
101 PROPYLBENZENE					n-PROPYLBENZENE
102 3-ETHYLTOLUENE					*1-ETHYL-3-METHYLBENZENE*; M-ETHYLTOLUENE
103 4-ETHYLTOLUENE					*1-ETHYL-4-METHYLBENZENE*; P-ETHYLTOLUENE
104 1,3,5-TRIMETHYLBENZENE			125000	170000	MESITYLENE
105 2-ETHYLTOLUENE					*1-ETHYL-2-METHYLBENZENE*; O-ETHYLTOLUENE
106 1,2,4-TRIMETHYLBENZENE	100 (2)	1000 (A)	125000	170000	PSUEDOCUMENE
107 tert.BUTYLBENZENE					*(1,1-DIMETHYLETHYL)BENZENE*
108 tert.BUTYLCYCLOHEXANE					
109 1,3-DICHLOROBENZENE					
110 1-DECENE	180000 (3)	60000 (A)			n-DECYLENE
111 1,5-DICHLOROPENTANE					
112 isoBUTYLBENZENE					
113 DECANE					*n-DECANE*
114 sec.BUTYLBENZENE					*(1-METHYLPROPYL)BENZENE*
115 1,2,3-TRIMETHYLBENZENE			125000	175000	HEMIMELLITENE
116 1ISOPROPYL4METHYLBENZENE					*METHYL(4-METHYLETHYL)BENZENE*; 3-ISOPROPYLTOLUENE; P-CYMENE
117 1,2-DICHLOROBENZENE					o-DICHLOROBENZENE
118 INDAN					*2,3-DIHYDRO-1H-INDENE*; 2,3-DIHYDROINDENE; HYDRINDENE
119 BUTYLCYCLOHEXANE					n-BUTYLCYCLOHEXANE; 1-CYCLOHEXYLBUTANE
120 1,3-DIETHYLBENZENE					m-DIETHYLBENZENE

Table 2 ctd.

The Volatile Organic Compounds Measured by the Gas Chromatographic System of MAMU #1

All concentrations are in ug/m^3 (micrograms per cubic metre)

		Standards, Guidelines or Provisional Guidelines	Criterion	TWA	STEL	Alternate Names
121	1,4-DIETHYLBENZENE					p-DIETHYLBENZENE
122	BUTYLBENZENE					n-BUTYLBENZENE
123	1,2-DIETHYLBENZENE					o-DIETHYLBENZENE
124	transDECAHYDRONAPHTHALENE					t-DECALIN; BICYCLO[4,4,0]DECANE
125	cis-DECAHYDRONAPHTHALENE					c-DECALIN; BICYCLO[4,4,0]DECANE
126	UNDECANE					*n-UNDECANE*; HENDECANE
127	1235-TETRAMETHYLBENZENE					ISODURENE
128	1234-TETRAMETHYLBENZENE					PREHNITENE
129	1,3-DIISOPROPYLBENZENE					*1,3-BIS(1-METHYLETHYL)BENZENE*
130	1234TETRAHYDRONAPHTHALENE					TETRALIN
131	1,4-DIISOPROPYLBENZENE					*1,4-BIS(1-METHYLETHYL)BENZENE*; ISOPROPYLCUMENE
132	DODECANE					*n-DODECANE*

Table 2 ctd.

The Volatile Organic Compounds Measured by the Gas Chromatographic System of MAMU #1

NOTES:
(1) Standard
(2) Guideline
(3) Provisional Guideline
(4) Standard for sum of o-, m-, & p-Xylenes

(A) Ambient Air Quality Criterion based on a 24-hour average concentration
(B) Ambient Air Quality Criterion based on a 1-hour average concentration
(please note; if the maximum 1-hour average concentration of a contaminant is LESS than the Criterion concentration based on a 24-hour average, then that Criterion has NOT been exceeded.)

TWA - Time Weighted Average for a normal 8-hour workday and a 40-hour workweek, to which nearly all workers may be repeatedly exposed without adverse effect.

STEL - Short Term Exposure Limit - concentration to which workers can be exposed for a short period of time (15 minutes) without adverse effect.

* - Denotes name approved by the International Union of Pure and Applied Chemistry (IUPAC).

Table 2 ctd.

Characteristics of the Common Contaminants as Measured Continuously by MAMU #1

All concentrations are in terms of ppm (parts per million)

	Standards, Guidelines or Provisional Guidelines (0.5 hr.)		Criterion (1-hr.)	TWA	STEL			Alternate Names
1 SULPHUR DIOXIDE	0.300		0.25	2	5		SO2	SULFUR DIOXIDE
2 TOTAL REDUCED SULPHUR	0.027	*	0.027	10	15	**	TRS	
3 NITROGEN OXIDES	0.25	***	N/A	-	-		NOx	OXIDES of NITROGEN
4 NITROGEN DIOXIDE	N/A		0.20	5	5		NO2	
5 NITRIC OXIDE	N/A		N/A	25	35		NO	NITROGEN MONOXIDE
6 OZONE	0.1		0.08	0.1	0.3		O3	
7 CARBON MONOXIDE	5.0		30.0	50	400		CO	

* As equivalent H2S and applicable only for Kraft Pulp Mills
TRS may contain any of the following: Hydrogen Sulphide (H2S), Methyl Mercaptan (CH3SH), Dimethyl Sulphide (C2H6S) and Dimethyl Disulphide (C2H6S2).

** The TWA and STEL for TRS is expressed solely for Hydrogen Sulphide concentrations

*** Expressed as NO2

N/A Not Applicable

Table 3

Scarborough 1988 Air Quality Survey

Monitoring Periods and Site Information - MAMU#1

Monitoring Period *	Start (hr/dd/mm)	Duration (hrs)	Locations	# GC Runs	Comments
A312	11:48/31/05	0.8	Physical Plant	-	On-site
A313	12:38/31/05	3.2	Physical Plant	-	On-site
A314	15:51/31/05	11.0	Physical Plant	-	Overnight
A012	09:51/01/06	2.3	Physical Plant	1	On-site
A013	12:49/01/06	3.4	Comstock Rd.	2	Downwind
A014	16:45/01/06	1.3	Centennial College	1	Upwind
A015	16:33/01/06	14.3	Physical Plant	-	Overnight
A022	09:38/02/06	3.8	Physical Plant	-	On-site
A023	14:13/02/06	1.5	Knob Hill Pk.lot	1	Downwind
A024	16:40/02/06	16.3	Physical Plant	-	Overnight
A032	10:03/03/06	2.0	Physical Plant	-	On-site
A033	12:21/03/06	3.3	Knob Hill Pk.lot	1	Downwind
A062	15:09/06/06	1.5	Warden/Comstock	1	Downwind
A063	17:32/06/06	14.8	Physical Plant	-	Overnight
A072	09:04/07/06	2.5	Physical Plant	-	On-site
A073	12:41/07/06	1.8	Faukland/Leahurst	1	Downwind
A074	14:51/07/06	2.2	Faukland/Leahurst	1	Downwind
A075	17:34/07/06	1.2	Centennial College	1	Upwind
A076	19:25/07/06	13.0	Physical Plant	-	Overnight
A082	08:56/08/06	2.7	Physical Plant	-	On-site
A083	12:06/08/06	5.5	Warden/Hymus Rd	3	Downwind
A084	17:54/08/06	1.4	Warden/Ashtonbee	1	Upwind
A085	19:45/08/06	12.6	Physical Plant	-	Overnight
A092	09:11/09/06	2.7	Physical Plant	-	On-site
A094	12:34/09/06	4.8	Warden/Comstock	2	Downwind
A095	17:37/09/06	1.5	Warden/Ashtonbee	1	Upwind
A096	19:28/09/06	12.9	Physical Plant	-	Overnight
A102	09:13/10/06	2.4	Physical Plant	-	On-site
A103	12:12/10/06	1.6	Warden/Hymus Rd.	1	Downwind
A104	14:09/10/06	1.3	Centennial College	1	Upwind

* In the designation of Monitoring Periods: 'A' refers to Mobile Air Monitoring Unit #1 (MAMU#1); the next two digits, the day of the month; and the final digit, the data acquisition episode of the day.

Table 4
Scarborough 1988 Air Quality Survey
Common Contaminants

Daytime Monitoring
Maximum ½-Hr Average Ground Level Concentrations (ppm)

Monitoring Period		TH-M	CO	NOx	NO_2	SO_2	Average Wind *
A312		2.6	0.8	0.03	0.02	nd.	na.
A313		3.4	1.3	0.03	0.02	nd.	na.
A012		1.6	0.6	0.03	0.02	0.02	na.
A013	D	1.9	0.7	0.03	0.02	0.03	3430
A014	U	0.3	0.2	0.02	0.02	nd.	3440
A022		0.9	0.3	0.02	0.01	nd.	na.
A023	D	1.6	1.4	0.11	0.03	nd.	1515
A032		0.8	0.4	0.03	0.02	nd.	na.
A033	D	1.3	1.4	0.10	0.03	nd.	1410
A062	D	1.5	2.3	0.13	0.05	nd.	3320
A072		0.9	1.2	0.07	0.04	nd.	na.
A073	D	0.9	1.9	0.04	0.02	nd.	0010
A074	D	1.3	3.1	0.13	0.05	nd.	3410
A075	U	0.9	1.1	0.04	0.03	nd.	0015
A082		0.8	0.6	0.06	0.03	nd.	na.
A083	D	1.2	1.3	0.05	0.03	nd.	3320
A084	U	1.1	1.6	0.08	0.03	nd.	3420
A092		0.8	0.3	0.03	0.02	nd.	na.
A094	D	1.0	0.8	0.04	0.02	nd.	3325
A095	U	1.1	1.3	0.08	0.02	nd.	3420
A102		1.1	0.6	0.03	0.02	nd.	na.
A103	D	1.2	0.8	0.02	0.02	nd.	3320
A104	U	1.1	0.6	0.01	0.01	nd.	3220

Overnight Monitoring
Maximum One-Hour Average Ground Level Concentrations (ppm)

Monitoring Period	TH-M	CO	NO_2	SO_2
A314	4.8	1.3	0.04	nd.
A015	0.3	0.8	0.03	nd.
A024	1.4	1.3	0.05	nd.
A063	1.6	5.1	0.04	nd.
A076	1.2	1.5	0.04	nd.
A085	1.3	0.8	0.03	nd.
A096	1.6	1.0	0.03	nd.

nd. - not detected; concentration in ambient air was less than detection limit of analyzer.
na. - not applicable; site on plant property adjacent to physical plant building.
* - the first two digits refer to the direction (in tens of degrees) from which the wind was blowing and the last two digits refer to the speed in km/hr.

Table 5

Scarborough 1988 Air Quality Survey - Major VOCs

GMC Plant at Eglinton and Warden

Concentration Units are ug/m^3

(Plant Shutdown on This Day)

	Sampling Date	June 1	June 1	June 1	June 1	June 2	June 3	June 6	June 7	June 7	June 7	June 8	June 8	June 8	June 8	June 9	June 9	June 9	June 10	June 10
	Monitoring Period	A012	A013	A013	A014	A023	A033	A062	A073	A074	A075	A083	A083	A083	A084	A094	A094	A095	A103	A104
		DW	DW	DW	UW	DW	DW	DW	DW	DW	UW	DW	DW	DW	UW	DW	DW	UW	DW	UW
	Sample Start Time	10:34	12:39	14:39	16:35	13:53	13:53	15:00	12:37	14:49	17:37	12:01	13:41	15:53	17:45	12:13	16:20	17:30	12:08	14:02
	Sample Duration	0.5-hr	1-hr	1-hr	1-hr	1-hr	1-hr	1-hr	1-hr	1-hr	1-hr	1-hr	1-hr	1-hr	1-hr	1-hr	1-hr	1-hr	1-hr	1-hr
1	PROPANE	9	3	5		4	3	5	8	28	5	20	36	20	4	2	2	5	4	1
2	2-METHYLPROPANE	47	6	4		7		8	8		3	3	4	4			2	6	5	1
3	BUTANE	131	25	17	5	18	18	30	22	28	10	9	14	14	24	11	6	14	13	3
4	2-METHYLBUTANE	100	23	17	6	16	18	28	23	33	10	10	11	16	24	12	6	14	12	
5	PENTANE	43	11	8	3	7	8	13	12	18	5	5	5	7	12	6	3	8	6	
6	HEXANE	10	23	24	1	8	6	7	8	13	2	3	6	6	7	6	3	6	6	
7	BENZENE	5	3	2	2	4	5	6	4	13	3	2	3	3	7	2		6		2
8	TOLUENE	103	74	69	5	39	27	32	38	36	51	33	38	24	52	20	10	40	30	3
9	ETHYLBENZENE	80	51	56	1	35	13	11			4	14	25	33	6	8	2	5	9	
10	XYLENES (m, p & O)	444	280	298	8	188	67	60		1	18	64	116	147	26	39	9	23	44	3
11	3-ETHYLTOLUENE	32	19	19		13	5	5			5	3	5	3	7	3	1	5	3	
12	1,3,5-TRIMETHYLBENZENE	30	18	18		12	6	5			5	3	4	3	8	3	1	6	3	
13	1,2,4-TRIMETHYLBENZENE	60	35	36	1	27	11	8	6	9	10	6	8	5	15	6	2	10	6	
	For the MAJOR VOCs																			
	Total Number Identified	13	13	13	9	13	12	13	9	9	13	13	13	13	12	12	12	13	12	6
	Total Organic Concentration	1093	573	574	33	376	188	220	129	179	131	176	275	284	193	117	49	148	141	13
	Total Alkanes	339	92	76	15	59	54	92	81	120	36	51	76	66	72	36	23	53	46	5
	Total Aromatics	754	482	498	18	317	134	127	48	59	95	125	199	217	121	80	26	94	95	8
	For ALL of the VOCs																			
	Total Number Identified	79	77	80	46	79	73	71	68	70	67	71	69	70	69	63	51	69	53	33
	Total Organic Concentration	1277	714	712	41	488	262	296	208	280	197	222	331	337	273	166	65	221	171	23

Table 6

Data Summary

Scarborough 1988 Air Quality Survey - GMC Plant

The Common Contaminants:

Ranges for Maximum Half-Hour Average Concentrations
(Units are ppm)

	TH-M	CO	NOx
Downwind Results (9 monitoring periods)	0.9 - 1.9	0.7 - 3.1	0.02 - 0.13
Upwind Results (5 monitoring periods)	0.3 - 1.1	0.2 - 1.6	0.01 - 0.08
On-Site Results (9 monitoring periods)	0.8 - 3.4	0.3 - 1.3	0.02 - 0.07
			NO2
Overnight Results (1-hour averages & 7 monitoring periods)	0.3 - 4.8	0.8 - 5.1	0.03 - 0.05

The Major VOCs:

Concentrations detected from 1-hour Samples
(Units are ug/m^3)

		Downwind Samples (14)		Upwind Samples (5)	
		Average	Maximum	Average	Maximum
1	PROPANE	11	36	4	5
2	2-METHYLPROPANE	9	47	4	6
3	BUTANE	26	131	11	24
4	2-METHYLBUTANE	23	100	14	24
5	PENTANE	11	43	7	12
6	HEXANE	9	24	4	7
7	BENZENE	4	13	4	7
8	TOLUENE	41	103	30	52
9	ETHYLBENZENE	28	80	4	6
10	XYLENES (m, p & o)	144	444	16	26
11	3-ETHYLTOLUENE	9	32	6	7
12	1,3,5-TRIMETHYLBENZENE	9	30	7	8
13	1,2,4-TRIMETHYLBENZENE	16	60	9	15
	Total Organic Concentrations	312	1093	104	193
	Total Alkanes	86	339	36	72
	Total Aromatics	226	754	67	121
	For ALL of the VOCs:				
	Total Number Identified	70	80	57	69
	Total Organic Concentrations	395	1277	151	273

Appendix B

(Plant Process Description and Operating Conditions)

General Motors Corporation of Canada Limited
1901 Eglington Avenue East
Scarborough, Ontario

The General Motors (Scarborough) plant is a van-assembly operation employing a staff of approximately 2,000 people. Production is based on two daily shifts covering the time period 07:00 hrs to 01:30 hrs, 5 days per week with scheduled weekend overtimes. An average of 390 vans are assembled daily during the week with a further 195 units being assembled during the Saturday production run. Annual vacation shut-down is normally from mid-July to mid-August.

Gaseous solvent emissions from paint spraying and oven drying operations are the principle environmental concern regarding this company's operation. Combined manual and fixed paint spray applications are used for surface coating of van bodies and wheel rims. Non-aqueous dispersion (NAD) enamel coatings are used for these finishes and the principle solvents include xylenes, toluene and isobutyl alcohol.

All spray booths are totally enclosed structures. Spray booth ventilation is achieved by either horizontal or down-draft air flow through water-wash curtains. Continuous direct fire, natural gas curing ovens are provided for the paint drying operations. Stack elevations vary from approximately 25 metres for the drying ovens to approximately 35 metres for the spray booths.

Except for June 7, the plant followed a normal production schedule during this air quality survey. On June 7, production was halted between 09:00 hrs and 17:00 hrs by union staff as a result of a safety matter. Plant engineering was not advised of this occurance until late in the day and consequently, Ministry staff were also not informed.

The van production at this plant for June 1 to June 10, 1988 was as follows:

June 1	94	(Wednesday)		June 6	102
June 2	94			June 7	370
June 3	483			June 8	385
June 4	100			June 9	24
June 5	302		(Friday)	June 10	421

The above van production represents an estimated total paint dosage of 32,000 litres based on an approximate 13.5 litres coverage per van.

The daily production sheets were provided to Ministry (Central Region) staff.

First Floor - Plant Layout

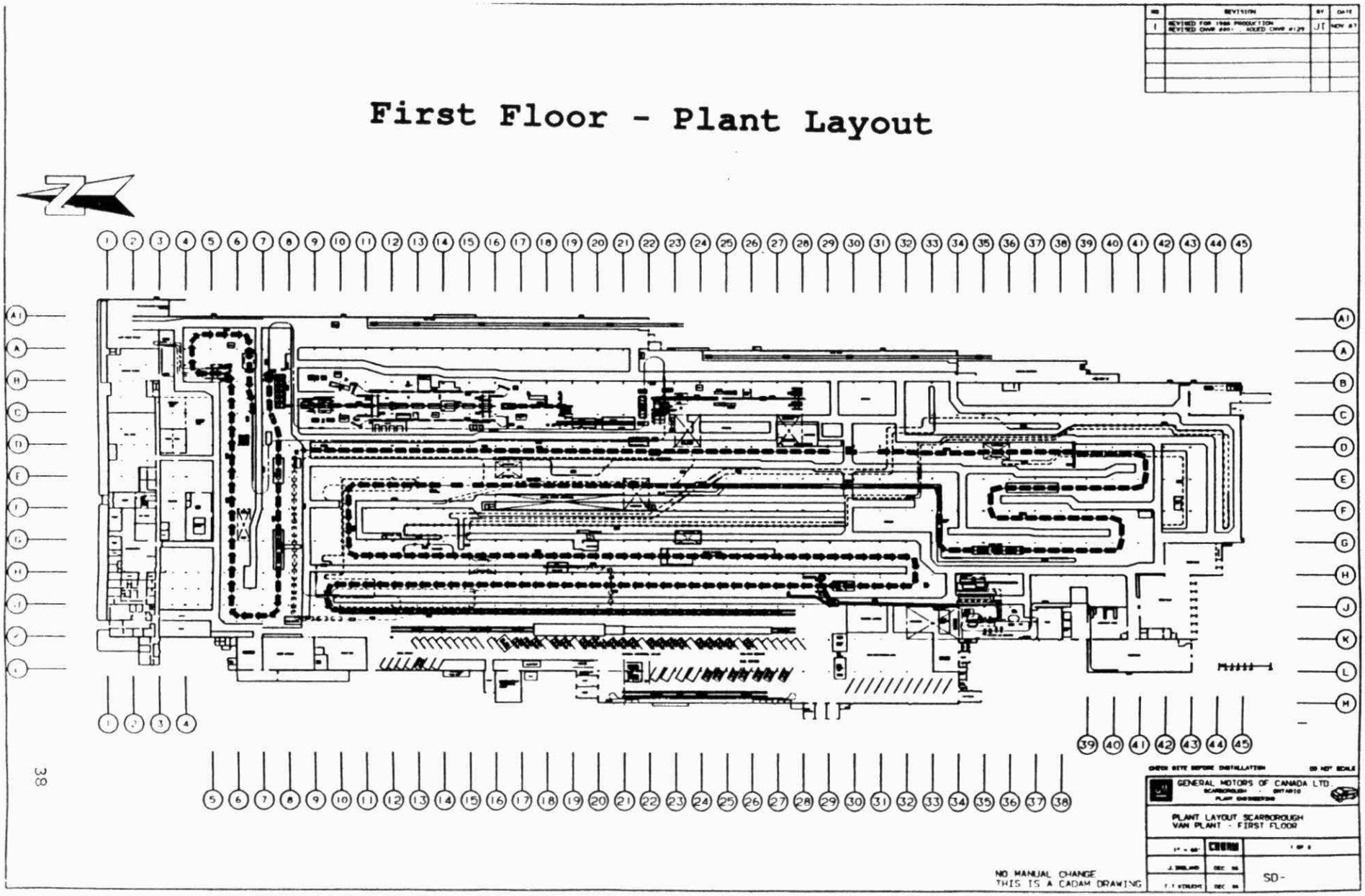


Figure 2a

Second Floor - Paint Coating Lines

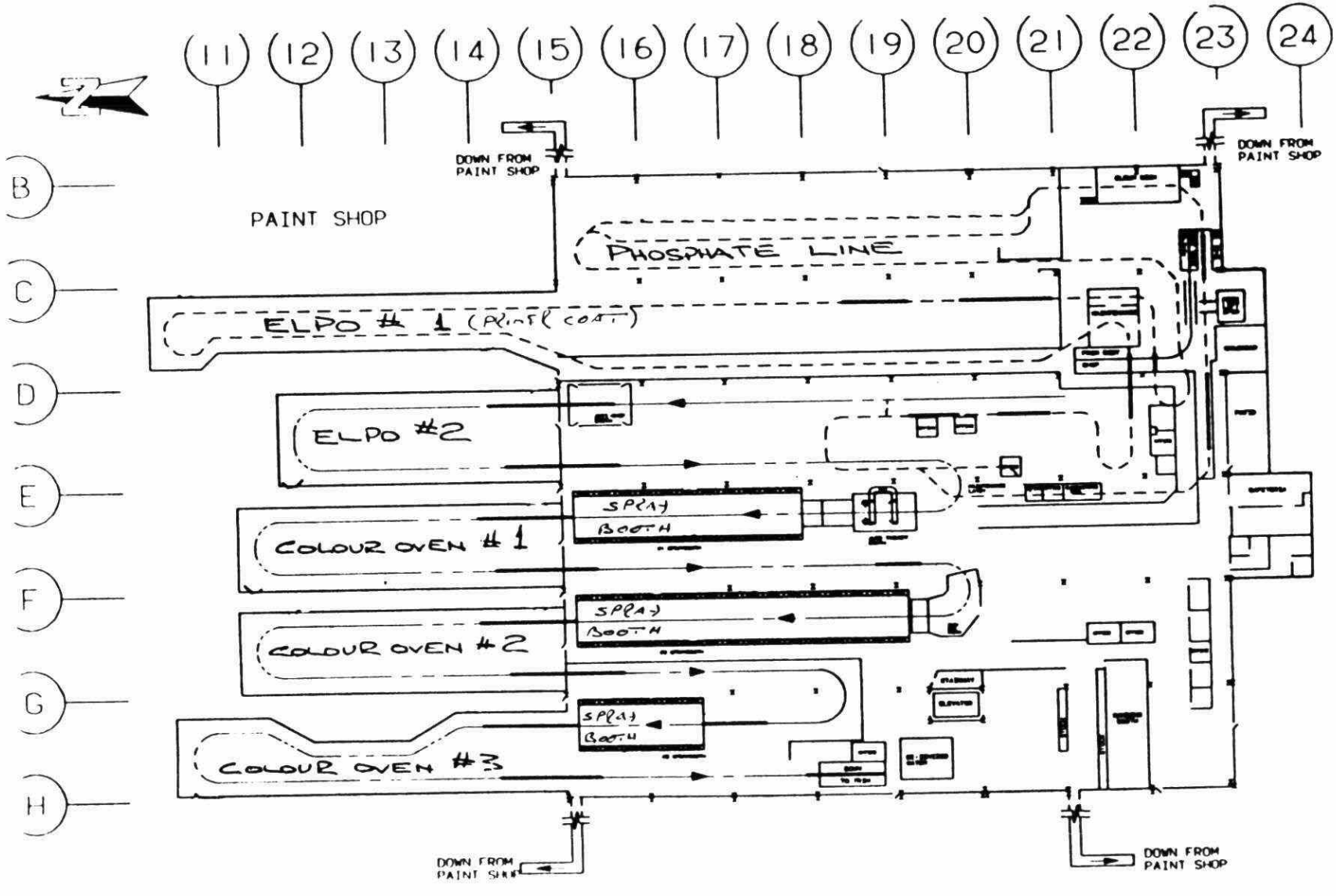


Figure 2b

TD
558.5
.U6
B42
1985